November 1990 A Cahners Publication

R&D

Research & Development

FOLLOW-THROUGH

3M's formula for success

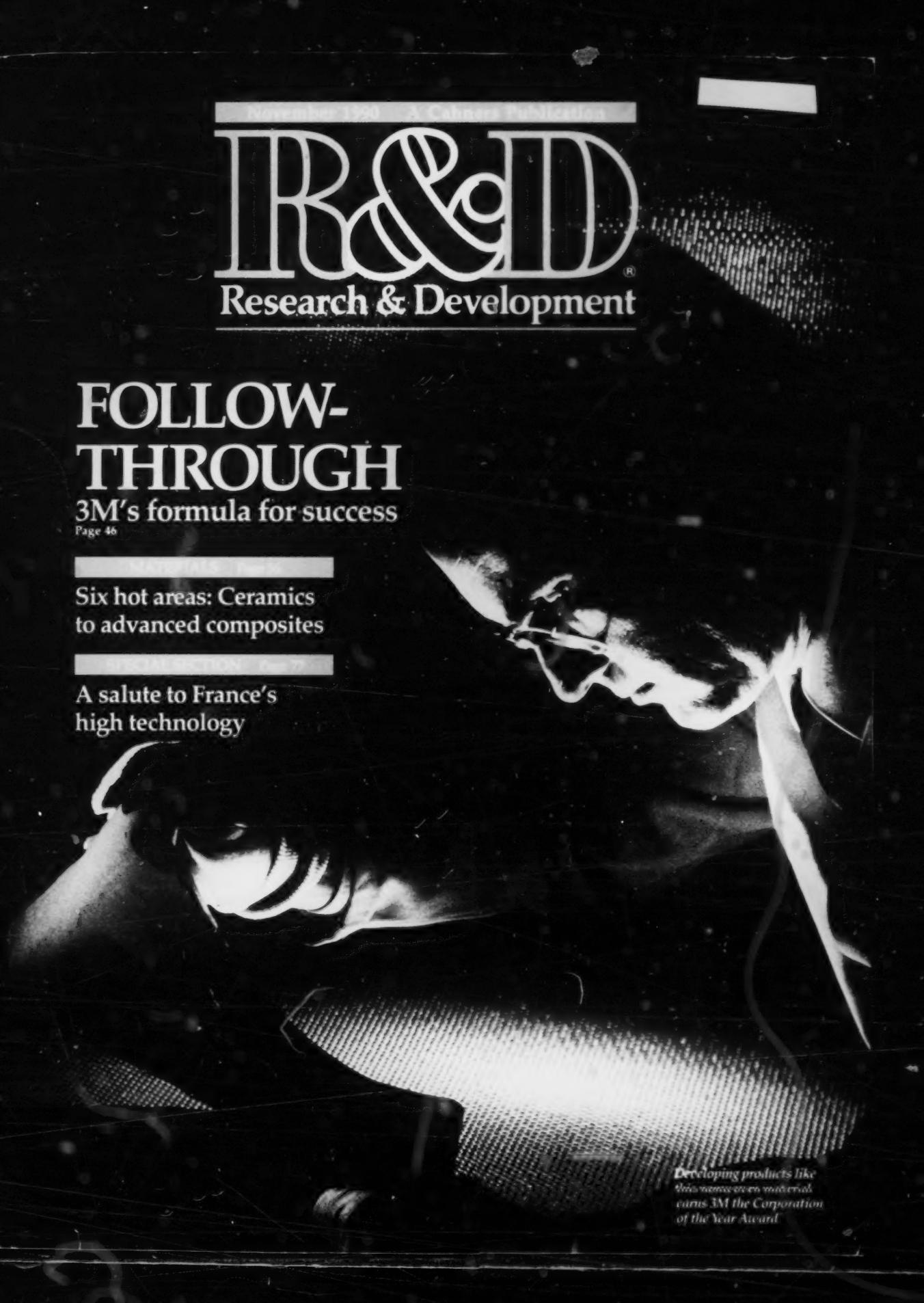
Page 46

MATERIALS PAGE

Six hot areas: Ceramics to advanced composites

SPECIAL SECTION Page 79

A salute to France's high technology

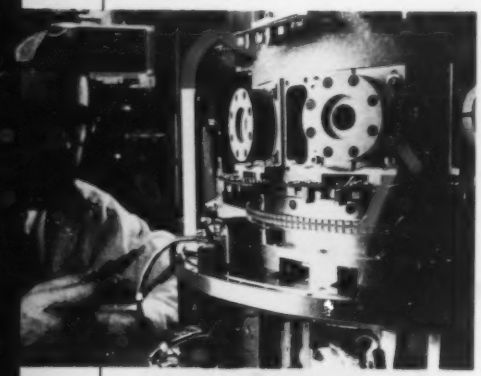


Developing products like this nonwoven material earns 3M the Corporation of the Year Award

INTERNATIONAL MAGAZINE OF RESEARCH AND DEVELOPMENT

R&D

CONTENTS



Corporation of the Year, page 46

Advanced materials, page 56

AWARDS

46 Follow-through: 3M's Formula for Success
R&D Magazine's Corporation of the Year takes high tech to dizzying heights by building on its best ideas.

MATERIALS

R&D Perspectives

56 Challenges and Opportunities In the New Age of Materials
Composites, alloys, and blends lead the field in materials research with improved properties and expanded applications.

68 Materials Resources

SALUTE TO FRENCH TECHNOLOGY

78 'Give Basic Research a Boost,' Says Research Minister
Physicist Hubert Curien vows to increase France's R&D spending to 3% of GNP—with industry's help.

80 The CNRS at 50
France's national research center is Europe's largest, with a complicated and somewhat checkered history.

86 France Secures Its Place In Space With CNES
With a staff of scientists more than 1,000 strong, CNES is a force to be reckoned with. Ask NASA.

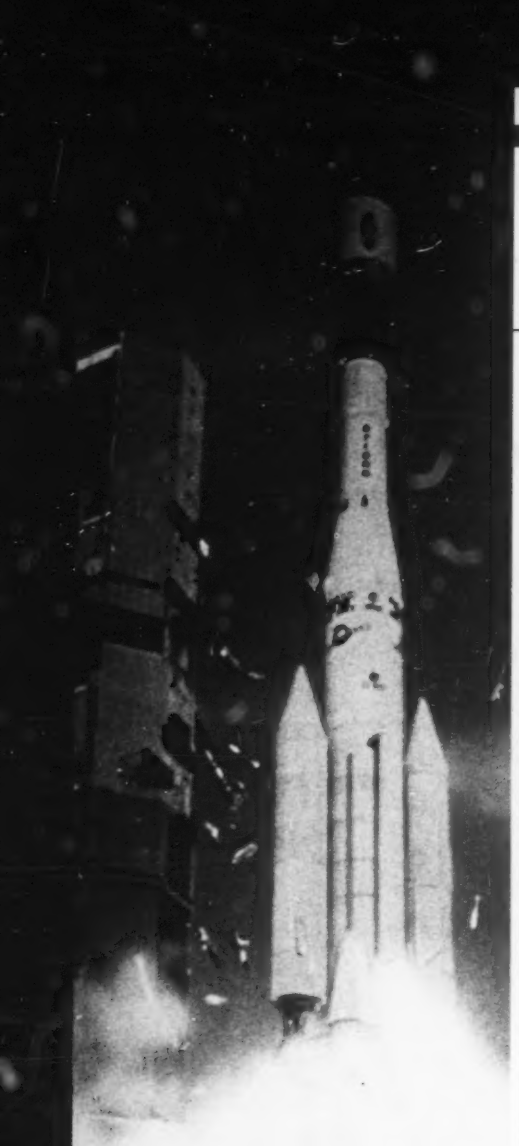
DEPARTMENTS

5 NEWS IN BRIEF
NSF pushes science education reform. AMA counters animal rights attacks. 'Buckeyball' is latest lab craze.

15 EDITORIAL
Wait for the silver lining in the 'New Europe.'

17 BUSINESS
TECHNOLOGY—Globalize your R&D, says MIT's Thomas Lee.
MATERIALS—Boom times ahead for advanced materials.
ROBOTICS—Lab robotics settle down.
COMPETITIVENESS—Do you know what your competitors are doing? consultant asks.
18 MANAGEMENT—Technology can take away managers' time, economist finds.

22 NEWS OF SCIENCE AND TECHNOLOGY
SCIENCE POLICY—Can ATP make a difference?
23 WASTE MINIMIZATION—Low-level nuclear waste takes a dive.
SOFTWARE—Researcher tries to instill survival instinct in robots.
24 OPTO-ELECTRONICS—Ultrasmall lasers reduce power needs.
OPTICS—Processing advance provides greater control over the properties of optical glass.
26 R&D FUNDING—Australian industry takes a liking to 150% tax concession.
SPACE—Navy looks into sea-to-space launch capability.
28 INSTRUMENTATION—SEM helps researchers understand the degradation of art.



French technology, page 77

ABOUT THE COVER

***3M earned the** Corporation of the Year award for its ability to "follow through" on new products, such as the nonwoven fabric shown in the photo. See story on page 46. Photo courtesy of 3M Corp.*

89 France Offers R&D Tax Breaks
Companies willing to build their labs outside Paris can cash in on generous tax incentives.

92 Rhône-Poulenc makes its move

94 Eurotunnel set for 1993

94 TGV revives the French railway

96 Alcatel scientists branch out
Equipment maker reports MBE advances

98 Snecma seeks better materials

100 Pechiney keeps forging ahead

102 Robot system tackles painting of airplanes

106 Science parks push research out from Paris

108 France's regional technopoles:
High interest in high-tech

111 Where to go for more information

113 French Technology Trade Shows

VACUUM TECHNOLOGY

116 This Custom System Analyzes Coatings Three Ways
Single-chamber design combines SEM with EDX and Auger spectroscopy to improve process development of magnetic disks.

31 MICROSCOPY—Researchers develop STM method that probes into materials.
32 INSTRUMENTS—Information update on surface sciences.
34 MILESTONES—Shoolery, NMR product champion, retires from Varian.
37 AWARDS—R&D 100 honors applied science.
LABORATORY DESIGN—Great labs combine form and function.

41 INDUSTRY EVENTS

43 INNOVATIVE NOTEBOOK
Nature does not give up her secrets easily, writes Jueneman in "The philosopher's stone."

125 PRODUCT DEVELOPMENT
Stephen Rudolph and W. David Lee give "More lessons from the field."

127 NEW PRODUCTS
Halogen light sources, planar magnetron sputtering system, and data acquisition boards are featured.

137 PRODUCT CENTER

143 LITERATURE
Brochures are available describing chromatography products, ultrahigh-vacuum scanning microscopes, and acrylic products for laboratory use.

152 ADVERTISERS INDEX

154 RESEARCH TRENDLETTER
Lethal brain disorder beamed away with zap of cyclotron energy. 'New-and-improved-air' cleans up diesel's act.

155 READER SERVICE CARD

R D

BUSINESS

Globalize your R&D, says MIT's Thomas Lee

GLOBALIZATION OF R&D, production, investment, and technology is a positive trend for the U.S. and the rest of the world, says Thomas Lee, a professor of electrical engineering at Massachusetts Institute of Technology, Cambridge. Lee is committee chair and author of the National Academy of Engineering report "National Interests in an Age of Global Technology."

The current U.S. policy of placing a high priority on basic research and "mission-oriented" technologies neglects national vulnerabilities, according to the committee. A higher priority should be placed on adapting technology, regardless of its origin, its report says.

The technical and economic vitality of any country, including the U.S., depends on how quickly and how effectively companies operating within its borders can exploit all the global resources and technical capabilities that are available in a global environment, says Lee.

Actions that he says the U.S. should take to exploit global technology include:

- supporting methods to adopt or adapt existing technologies, such as those in the National Science Foundation's Engineering Research Centers
- supporting generic technologies, such as total quality control, computer-aided design, and just-in-time production systems
- encouraging modernization of capital equipment in private industry
- hiring and training employees to have greater technical expertise in agencies responsible for domestic and international economic policy.

The report also lists emerging technologies and various countries' strengths in several industries, including aircraft engines, automotive, biotechnology, chemicals, semiconductors, and electrical equipment.

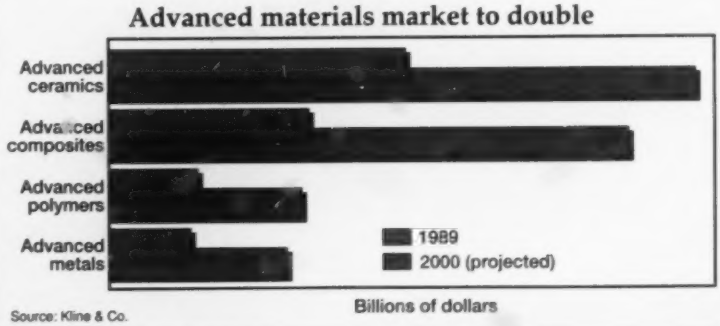
To get a copy of the report, call 202/334-3313. —*Tim Studt*

Boom times ahead for advanced materials

ELECTRONICS MANUFACTURERS will pay up to $1,000/lb for a high-performance circuit board," says Carl Eckert, vice president of Kline & Co., a Metuchen, NJ, market research firm.

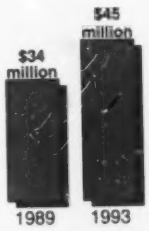
The advanced materials industry, which includes advanced composites, polymers, metals, and ceramics, is in the midst of a technological explosion that is creating major economic opportunities for companies willing to commit technical resources.

Eckert singles out 11 companies as active players in advanced materials—Alcoa, Allied-Signal, Dow Chemical, DuPont, General Electric, ICI, Norton, BASF, Hercules, British Petroleum, and Ciba-Geigy. □



***Advanced composites,** with 10% annual growth, are the fastest growing materials market segment. For more materials research information, see the Perspectives section.*

Lab robotics settle down



The rapid growth that characterized the laboratory robotics market a few years ago seems to be over, but the worldwide market still is expected to continue to expand more than 7% annually to $45 million in 1993, according to Strategic Directions Intl., a Los Angeles-based marketing research firm.

The leading industrial users of laboratory robotics systems work in pharmaceuticals, chemicals, petroleum, or biotechnology. The majority of applications are in process and product analytical support and applied R&D and quality control in life sciences.

Do you know what your competitors are doing? consultant asks

WITH TODAY'S climate of rapid technological change, where your competitors introduce and improve products daily, the need for competitive intelligence is increasingly important, says Michael Esposito, a vice president of Arthur D. Little Inc., a Cambridge, MA-based management and technology consulting firm.

"Competitive surprises can put a company out of business," says Esposito. A company needs to know early on what technologies the competition is working on so it can respond to changes appropriately.

"Competitive intelligence is not corporate spying," Esposito says. It doesn't involve breaking into offices or buying information from disgruntled ex-employees, he says.

You can get almost everything you need from public information, such as magazine and newspaper articles, annual reports, filings for debt or stock offerings, speeches and articles by scientists, and reports from securities analysts.

Computerized databases also can be used to access thousands of jour-

R&D

ADVERTISERS INDEX

	Page No.	Circle No.
ADPI/Analog & Digital Peripherals, Inc.	137	191
A.E.D. Inc.	139	202
Air France	104	162
Alcatel CIT	90-91	156
ALCOA/Aluminum Company of America	73	150
Alconox Inc.	69	144
ALPHAGAZ, Div. of Liquid Air Corp.	27	116
Arconium Corporation	26	115
Asyst Software Technologies, Inc.	42	131
Atari Corp.	45	133
BHK, Inc.	136	198
Balzers	51	134,135
Barnant Company	140	211
Bordeaux Technipole	112	166
†Bruel & Kjaer	98A	21
Buehler Ltd.	BC	228
Burrell Corporation	32	122
CNES	95	157
Cahn Instruments, Inc.	35	126
Cahners Publishing Co.	141	
CERAC, Incorporated	149	219
Cite Des Sciences	113	167
Clestra Clean Room Technology	101	160
Colder Products Company	137	190
Cole-Parmer Instrument Co.	41	130
Coulter Corp./Scientific Instruments	4	102
Cyber Research, Inc.	138	197
DEL Electronics Corp.	53	136
Danielson Associates	122	171
Dantec Electronics, Inc.	139	205
Despatch Industries, Inc.	140	209
Dialog Information Services	55	138
Digital Instruments, Inc.	146	215
DuPont Co.	75	152
Duralab Equipment Corp.	129	178
EPE Technologies, Inc.	83-85	154
Edwards High Vacuum Inc.	153	226
Elek-Tek	124	175
Fluid Dynamics Intl.	20	112
French Industrial Development Agency	109	164
Futrex, Inc.	149	220
GMW Associates	135	186
	148	218
GW Instruments, Inc.	114	168
Galactic Industries Corp.	134	183
Gifts-In-Kind Clearing House	134	184
Glassman High Voltage Inc.	36	127
Granville Phillips	121	170
Hamilton Company	9	104
Harrop Industries, Inc.	71	148
	140	208
Heath Company	137	192
†Heinemann Professional Publishing	98B	
Hitachi Scientific Instruments	66	142
Horiba Instruments, Inc.	34	124,125
Huntington Laboratories, Inc.	122	173
IHS, an Inductoheat Company	135	185
INCO Specialty Powder Products	147	216
Insulator Seal Incorporated	115	169
KSV Instruments	69	145
Kano Laboratories	138	196
Kilovac Corp.	140	212
Kratos Analytical, Inc.	12	106
Labconco Corp	137	193
Lab-Line Instruments Inc.	139	204
Lab-Tech '91	123	174
Laboratory Technologies Corp.	13	107
Lasertec USA	28	117
Lasertechnics	74	151
Leister Hot Air Tools	150	222
Link Analytical	21	113
MDC Vacuum Products Corp.	30	119
MMR Technologies, Inc.	72	149
Math Works, Inc.	67	143
Melles Griot	131	180
Metropolitan Toulouse	110	165
Micromeritics Instrument Corp.	130	179
Nancy Agglomeration	88	155
National Electrostatics Corp.	133	231
National Instruments	IBC	227
Neslab Instruments Inc.	128	177
Newport Corporation	IFC	100
Nicolet Analytical Instruments	14	108
Nicolet Test Instruments Div.	44	132
Nikon Inc. Instrument Group	19	111
Nor-Cal Products, Inc.	61	139
NordicTrack	133	
Northwest Airlines	142	
Novamet Specialty Products Corp., An INCO Co.	135	187
Olympus Corporation	126	176
	139	201
	144	229,230
Omega Engineering, Inc.	3	101
Optical Coating Laboratory, Inc.	16	109
FL Thermal Sciences	63	140
Parr Instrument Co.	138	195
Pechiney	76	153
Perkin-Elmer Corp.	8	103
Planar	139	203
Polaroid	10-11	105
R&D 100	136	188
R&D Lab of the Year	151	224
Rennes Atalante	105	163
Rhone-Poulenc	97	158
Rolyn Optics	140	207
SLM Instruments, Inc.	133	182
SNECMA	103	161
SSC, Inc.	122	172
Schott Corp.	38-39	129
Silicon Casting, Inc.	32	121
Sophia Antipolis	99	159
Spectra Tech Applied Systems	150	223
Spectra-Tech, Inc.	145	214
Stano Components	137	194
Stat-Ease Inc.	71	146
	137	189
Stellar Software	153	225
Surcom Associates, Inc.	138	199
Synrad, Inc.	31	120
3M Company	40	
Technics	65	141
Thermolyne Corp.	29	118
	140	210
TriMetrix	149	221
US Inc.	71	147
Ulvac Corporation	54	137
Vacuum Instrument Corp.	139	206
Varian Associates	25	114
Velmex, Inc.	138	200
Watlow	132	181
Whitey Co., A Swagelok Co.	18	110
Yokogawa Corp. of America	33	123
Carl Zeiss Inc.	37	128
Zeta Computer Graphics	148	217

†Foreign

CIRCULATION

R&D (ISSN 0746-9179), formerly *Research & Development*, is published monthly except semimonthly in February by The Cahners Publishing Company, A Division of Reed Publishing USA, 275 Washington St., Newton, MA 02158-1630. Terrence M. McDermott, President; Charles E. Moodhe, Senior Vice President/General Manager, Chicago Division; Jerry D. Neth, Senior Vice President/Publishing Operations; J.J. Walsh, Senior Vice President/Finance; Thomas J. Dellamaria, Senior Vice President/Production and Manufacturing.; Ralph Knupp, Vice President/Human Resources; Bill Lindsey, Publisher; Neil P. Ruzic, founder of *Industrial Research*.

Circulation records are maintained at Cahners Publishing Company, 44 Cook St., Denver, CO 80206-5800. Phone: 303/388-4511. **Circulation:** More than 120,000 copies distributed. Second-class postage paid at Denver, CO 80206-5800, and at additional mailing offices. **Postmaster:** Send address corrections to *R&D* at P.O. Box 173377, Denver, CO 80217-3377.

R&D copyright 1990 by Reed Publishing USA; Ronald G. Segel, Chairman and Chief Executive Officer; Robert L. Krakoff, President and Chief Operating Officer; William M. Platt, Senior Vice President.

Subscription rates for nonqualified people: USA, 1 yr $49.95, 2 yr $89.95; Canada and Mexico, 1 yr $69.95, 2 yr $139.95; all other countries, 1 yr $85, 2 yr $160; air mail surcharge, 1 yr $130, 2 yr $250. Except for special issues where price changes are indicated, single copies of regular issues are available for $10. Address all subscription mail to *R&D*, 44 Cook St., Denver, CO 80206-5800. Include zip code and, for change of address, copy of old label.

All rights reserved. No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, or by any information storage retrieval system, without written permission of the copyright owner. Prices for bulk reprints of articles available on request. Copies of back issues are available from University Microfilm, 300 N. Zeeb Rd., Ann Arbor, MI 48106, and on microfiche from Micro-Photo Div., Bell & Howell, Old Mansfield Rd., Wooster, OH 44691. *R&D* articles are indexed in Engineering Index, Current Contents, and New York Times Information Bank.

Cahners Publishing Company, A Division of Reed Publishing USA □ Specialized Business Magazines for Building & Construction □ Research □ Technology □ Electronics □ Computing □ Printing □ Publishing □ Health Care □ Foodservice □ Packaging □ Environmental Engineering □ Manufacturing □ Entertainment □ Home Furnishings □ Interior Design. □ Specialized Consumer Magazines for Child Care □ Boating □ Wedding Planning.

ABP VBPA